

Figure 1 – Starting sequence used for the codon modification of MUC1. The MUC1 expression cassette sequence is taken from the vector JNW656. Start and stop codons are bolded. Kozak sequence is italicised. Restriction sites are underlined.

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5  GCTAGCGCCACCATGTCTAGAACACCGGGCACCCAGTCTCCTTTCTTCCTGCT
   GCTGCTCCTCACAGTGCTTACAGTTGTTACAGGTTCTGGTCATGCAAGCTCTAC
   CCCAGGTGGAGAAAAGGAGACTTCGGCTACCCAGAGAAGTTCAGTGCCCAGCT
   CTACTGAGAAGAATGCTGTGAGTATGACCAGCAGCGTACTCTCCAGCCACAGcC
10  CCGGTTCAGGCTCCTCCACCACTCAGGGACAGGATGTCACTCTGGCCCCGGCC
   ACGGAACCAGCTTCAGGTTTCAGCTGCCACCTGGGGACAGGATGTCACCTCGGT
   CCCAGTCACCAGGCCAGCCCTGGGCTCCACCACCCCGCCAGCCCACGATGTC
   ACCTCAGCCCCGGACAACAAGCCAGCCCCGGGCTCCACCGCCCCCCCCAGCCC
   ACGGTGTCACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCCCC
15  CCCAGCCCACGGTGTCACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCC
   ACCGCCCCCCCCAGCCCACGGTGTCACCTCGGCCCCGGACACCAGGCCGGCCC
   CGGGCTCCACCGCCCCCCCCAGCCCACGGTGTCACCTCGGCCCCGGACACCAG
   GCCCCGCCCCGGGCTCCACCGCCCCCCCCAGCCCACGGTGTCACCTCGGCCCCG
   GACACCAGGCCCGCCCCGGGCTCCACCGCGCCCCGACGCCACGGTGTCACCT
20  CGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCCCCCCAAGCCCACG
   GTGTACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCCCCCCC
   AGCCCATGGTGTCACCTCGGCCCCGGACAACAGGCCCGCCTTGGGCTCCACC
   GCCCTCCAGTCCACAATGTACCTCGGCCTCAGGCTCTGCATCAGGCTCAGC
   TTCTACTCTGGTGCAACGGCACCTCTGCCAGGGCTACCACAACCCAGCCA
25  GCAAGAGCACTCCATTCTCAATTCAGCCACCACTCTGATACTCCTACCACCC
   TTGCCAGCCATAGCACCAAGACTGATGCCAGTAGCACTCACCATAGCACGGTA
   CCTCCTCTCACCTCCTCCAATCACAGCACTTCTCCCCAGTTGTCTACTGGGGTC
   TCTTTCTTTTCTCTGTCTTTTCACATTTCAAACCTCCAGTTTAATTCTCTCTGGA
   AGATCCCAGCACCGACTACTACCAAGAGCTGCAGAGAGACATTTCTGAAATGTT
30  TTTGCAGATTTATAAACAAGGGGGTTTTCTGGGCCTCTCCAATATTAAGTTCAG
   GCCAGGATCTGTGGTGGTACAATTGACTCTGGCCTTCCGAGAAGGTACCATCA
   ATGTCCACGACGTGGAGACACAGTTCAATCAGTATAAAACGGAAGCAGCCTCTC
   GATATAACCTGACGATCTCAGACGTCAGCGTGAGTGATGTGCCATTTCTTTTCT
   CTGCCCAGTCTGGGGCTGGGGTGCCAGGCTGGGGCATCGCGCTGCTGGTGCT
35  GGTCTGTGTTCTGGTTGCGCTGGCCATTGTCTATCTCATTGCCTTGGCTGTCTG
   TCAGTGCCGCCGAAAGAACTACGGGCAGCTGGACATCTTTCCAGCCCGGGATA
   CCTACCATCCTATGAGCGAGTACCCACCTACCACACCCATGGGCGCTATGTG
   CCCCTAGCAGTACCGATCGTAGCCCCTATGAGAAGGTTTCTGCAGGTAATGG
   TGGCAGCAGCCTCTCTTACACAAACCCAGCAGTGGCAGCCACTTCTGCCAACTT
40  GTCTAGATAGCTCGAG

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Figure 2 – MUC1 sequence devoid of the 7x VNTR repeat sequence, prior to codon modification. The start and stop codons are bolded. Restriction cloning sites are underlined. The BlnI and BbvCI sites for insertion of the 7x VNTR fragment are double underlined.

5  
**ATG**CTAGAACACCGGGCACCCAGTCTCCTTTCTTCCTGCTGCTGCTCCTCACA  
 GTGCTTACAGTTGTTACAGGTTCTGGTCATGCAAGCTCTACCCCAGGTGGAGAA  
 AAGGAGACTTCGGCTACCCAGAGAAGTTCAGTGCCCAGCTCTACTGAGAAGAA  
 10 TGCTGTGAGTATGACCAGCAGCGTACTCTCCAGCCACAGCCCCGGTTCAGGCT  
 CCTCCACCACTCAGGGACAGGATGTCACTCTGGCCCCGGCCACGGAACCAGCT  
 TCAGGTTTCAGCTGCCACCTGGGGACAGGATGTCACCTCGGTCCCAGTCACCAG  
 GCCAGCCCTGGGCTCCACCACCCCGCCAGCCCACGATGTCACCTCAGCCCCG  
 GACAACAAGCCCAATGTCACCTCGGCCTCAGGCTCTGCATCAGGCTCAGCTTC  
 TACTCTGGTGCACAACGGCACCTCTGCCAGGGCTACCACAACCCAGCCAGCA  
 15 AGAGCACTCCATTCTCAATTCCCAGCCACCACTCTGATACTCCTACCACCCTTG  
 CCAGCCATAGCACCAAGACTGATGCCAGTAGCACTCACCATAGCACGGTACCT  
 CCTCTCACCTCCTCCAATCACAGCACTTCTCCCCAGTTGTCTACTGGGGTCTCT  
 TTCTTTTCTCCTGTCTTTTACATTTCAAACCTCCAGTTTAATTCCTCTCTGGAAGA  
 TCCCAGCACCGACTACTACCAAGAGCTGCAGAGAGACATTTCTGAAATGTTTTT  
 20 GCAGATTTATAAACAAGGGGGTTTTCTGGGCCTCTCCAATATTAAGTTCAGGCC  
 AGGATCTGTGGTGGTACAATTGACTCTGGCCTTCCGAGAAGGTACCATCAATGT  
 CCACGACGTGGAGACACAGTTCAATCAGTATAAAACGGAAGCAGCCTCTCGATA  
 TAACCTGACGATCTCAGACGTCAGCGTGAGTGATGTGCCATTTCTTTCTCTGC  
 CCAGTCTGGGGCTGGGGTGCCAGGCTGGGGCATCGCGCTGCTGGTGCTGGTC  
 25 TGTGTTCTGGTTGCGCTGGCCATTGTCTATCTCATTGCCTTGGCTGTCTGTCAG  
 TGCCGCCGAAAGAACTACGGGCAGCTGGACATCTTTCCAGCCCCGGGATACCTA  
 CCATCCTATGAGCGAGTACCCACCTACCACACCCATGGGCGCTATGTGCCCC  
 CTAGCAGTACCGATCGTAGCCCCTATGAGAAGGTTTCTGCAGGTAATGGTGGC  
 AGCAGCCTCTCTTACACAAACCCAGCAGTGGCAGCCACTTCTGCCAACTTGTCT  
 30 AGATAG

Figure 3 – Two representative MUC1 codon modified sequences

## Sequence 1

5 ATGAGCCGGACCCCTGGCACCCAGTCTCCATTCTTCCTGCTCCTGCTGCTCAC  
 CGTGCTGACCGTGGTGACGGGAAGCGGCCACGCTTCGTCCACGCCCCGGCGGC  
 GAGAAGGAAACCAAGTGCAACCCAGCGCAGCTCCGTGCCCAGCTCCACCGAGA  
 AAAACGCTGTGAGCATGACGTCCAGTGTCTCTCTAGCCATAGCCCCGGCTCT  
 10 GGGAGCAGTACCACCCAGGGCCAGGACGTGACTCTCGCCCCCGCTACGGAGC  
 CCGCTTCTGGCTCCGCCGCCACCTGGGGCCAGGACGTGACCTCTGTGCCGGT  
 CACACGCCCTGCTCTGGGCTCTACCACTCCTCCTGCCCATGACGTGACCTCGG  
 CTCCGGACAATAAGCCCAACGTGACGAGTGCCAGCGGGAGCGCCTCGGGGTC  
 CGCCAGTACCCTGGTGCATAACGGGACCAAGTGCTAGGGCCACCACCACCCCC  
 GCGTCGAAGAGCACCCCCCTTCTCTATCCCGTCTCATCATAGCGACACACCTACA  
 15 ACCCTGGCGAGCCACAGCACCAAGACCGACGCTTCTTCCACACATCATAGCAC  
 CGTGCCACCACTCACCAGCTCCAACCATTCACCAGCCCCCAGCTGAGCACCG  
 GAGTGTCTTCTTCTTCTTCTGAGCTTCCATATCAGTAACCTCCAGTTCAACTCCAG  
 CCTCGAGGACCCCTCTACCGACTACTATCAGGAGCTGCAGCGGGACATCAGCG  
 AGATGTTTCTGCAGATCTACAAGCAGGGGGGCTTCTCCTCGGCCTGTCTAACATCA  
 20 AGTTCGCCCCCGGCAGCGTCGTGGTGCAGTTGACCCTGGCCTTCCGGGAGGG  
 CACCATCAACGTGCACGACGTGGAGACCCAGTTCAACCAGTACAAGACCGAGG  
 CCGCCAGCAGGTATAACCTGACCATCTCCGACGTCTCTGTGAGCGACGTCCCC  
 TTCCCTTTCTCCGCCCAGAGCGGCGCTGGGGTGCCCCGGCTGGGGCATCGCCT  
 TGCTCGTGCTGGTGTGCGTGCTGGTGGCCCTGGCCATCGTGTACCTGATCGCC  
 25 CTGGCCGTCTGTCAATGCAGGCGCAAGAACTACGGCCAGCTCGACATCTTCCC  
 AGCTCGGGATACCTATCATCCCATGAGCGAGTACCCACCTACCACACCCATG  
 GCCGCTACGTTCTTCTCCCTCCAGCACCGACCGCAGCCCTTACGAGAAGGTGAGC  
 GCCGGGAATGGGGGGAGTTCTCTCTTACACAAACCCCGCCGTGGCCGCCA  
 CGAGCGCCAACCTCTCCAGGTGA  
 30

## Sequence 2

ATGTCCCGCACCCCTGGCACCCAGTCCCCCTTCTTTCTCCTGCTGCTGCTCACC  
 GTGCTGACCGTCGTGACCGGCAGTGGGCATGCGTCCTCGACGCCCGGCGGCG  
 35 AGAAGGAGACCAGTGCTACCCAGCGCAGCTCTGTGCCTTCCAGCACGGAGAAG  
 AACGCTGTGAGTATGACTTCCTCCGTGCTGAGCTCCCATAGCCCCGGCTCGGG  
 CAGCTCCACCACCCAGGGGACAGGACGTGACACTGGCTCCCGCAACCGAGCCC  
 GCCTCTGGCTCTGCCGCCACCTGGGGCCAGGACGTGACATCCGTGCCCGTGA  
 CCCGCCCGCCCTGGGCAGCACCAACCCCCCTGCTCATGACGTACCTCTGC  
 40 GCCTGACAACAAGCCTAACGTGACGTCCGCTTCCGGCAGCGCCTCCGGGTCC  
 GCCTCCACACTGGTGCATAACGGAACCTCCGCGCGCGCCACCACCACCCAG  
 CGAGCAAGAGCACCCCTTCTCTATCCCCTCCCATCATAGCGACACACCCACCA  
 CGCTGGCCAGCCATAGCACCAAAACCGACGCCTCTAGCACCCACCACTCCACG  
 GTGCCCCCCTGACCTCCAGCAACCATTCTACCTCCCCCAGCTGAGCACGGG  
 45 GGTGAGCTTTTTCTTCTGTCTTCCATATCAGCAACCTCCAGTTCAATTCCTCT  
 CTGGAGGACCCAGCACCGACTACTACCAAGAGCTGCAGCGGGACATCTCCGA  
 GATGTTCTTGCAGATCTACAAACAGGGGCGGCTTCTTGGGATTGAGCAACATCAA  
 GTTCCGCCCGGGTCCGTGGTGGTGCAGCTCACCTGGCCTTCAGGGAGGGC  
 ACCATCAACGTGCATGACGTGAGACCCAGTTCAATCAGTATAAGACCGAGGC  
 50 CGCCTCCCGGTACAACCTGACGATCAGCGACGTGTCTGTGTCCGACGTGCCCT  
 TCCCCTTCTCCGCACAGTCCGGCGCCGGCGTGCCGGGCTGGGGCATCGCCCT

GCTCGTGTTGGTGTGCGTGCTCGTGGCCCTCGCCATCGTGTACCTGATCGCCC  
TGGCCGTCTGTCAGTGCAGGAGAAAGAACTATGGGCAGTTGGATATCTTCCCC  
GCCAGGGACACCTACCACCCCATGTCCGAGTACCCACCTACCACACCCACGG  
CCGCTATGTCCCTCCCTCCTCGACCGACCGCTCCCCTTACGAGAAGGTGAGCG  
5 CCGGCAACGGAGGCAGCTCCCTGTCCTACACCAACCCTGCCGTGGCCGCCAC  
AAGCGCCAACCTGAGCCGCTGA

Figure 4 – Engineered MUC1 codon modified sequence including restriction sites (underlined), Kozak sequence (italicised), start and stop codons (bolded), BbvCI (boxed) and BlnI (boxed). The later two features are essential for the re-introduction of the 7x VNTR fragment.

5  
GCAGGCGGCCGCGCTAGCGCCACCAT**GT**CTAGAAACCCCTGGCACCCAGTCCC  
CCTTCTTTCTCCTGCTGCTGCTCACC**GT**GCTGACCGTCGTGACCGGCAGTGGG  
CATGCGTCCTCGACGCCCCGGCGGCGAGAAGGAGACCA**GT**GCTACCCAGCGCA  
10 GCTCTGTGCCCTTCCAGCACGGAGAAGAACGCTGTGAGTATGACTTCCCTCCGTG  
CTGTCCTCCCATAGCCCCGGCTCGGGCAGCTCCACCACCCAGGGGCAGGACG  
TGACACTGGCTCCCGCAACCGAGCCCGCCTCTGGCTCTGCCGCCACCTGGGG  
CCAGGACGTGACATCCGTGCCCGTGACCCGCCCGCCCTGGGCAGCACCA**CC**  
CCCCCTGCTCATGACGTCA**CCTCAGC**GCCTGACAACAAGCCTAACGTGACGTC  
15 CGCTTCCGGCAGCGCCTCCG**GCTCAGC**CTCCACACTGGTGCATAACGGAACCT  
CCGCGCGCGCCACCACCCACCCAGCGAGCAAGAGCACCCCTTCTCTATCCCC  
TCCCATCATAGCGACACACCCACCA**CG**CTGGCCAGCCATAGCACCAAAACCGA  
CGCCTCTAGCACCCACCACTCCACGGTGCCCCCCTGACCTCCAGCAACCATT  
CTACCTCCCCCAGCTGTCCACGGGGGTGAGCTTTTTCTTCCTGTCCTTCCATA  
20 TCAGCAACCTCCAGTTCAATTCCTCTCTGGAGGACCCAGCACCGACTACTACC  
AAGAGCTGCAGCGGGACATCTCCGAGATGTTCCCTGCAGATCTACAAACAGGGC  
GGCTTCCTGGGATTGAGCAACATCAAGTTCGCCCCGGGTCCGTGGTGGTGCA  
GCTCACCCCTGGCCTTCAGGGAGGGCACCATCAACGTGCATGACGTCGAGACCC  
AGTTCAATCAGTATAAGACCGAGGCCGCCTCCCGGTACAACCTGACGATCAGC  
25 GACGTGTCTGTGTCCGACGTGCCCTTCCCCTTCTCCGCACAGTCCGGCGCCGG  
CGTGCCGGGCTGGGGCATCGCCCTGCTCGTGTTGGTGTGCGTGCTCGTGGCC  
CTCGCCATCGTGTACCTGATCGCCCTGGCCGTCTGTCAGTGCAGGAGAAAGAA  
CTATGGGCAGTTGGATATCTTCCCCGCCAGGGACACCTACCACCCCATGTCCG  
AGTACCCACCTACCACACCCACGGCCGCTATGTCCCTCCCTCCTCGACCGAC  
30 CGCTCCCCTTACGAGAAGGTGAGCGCCGGCAACGGAGGCAGCTCCCTGTCCT  
ACACCAACCCTGCCGTGGCCGCCACAAGCGCCAACCTGTCTAGATGACTCGAG  
GGATCCGCAG

Figure 5 – Final codon modified sequence of the MUC1 expression cassette containing the 7x VNTR fragment from JNW758. This cassette has a codon coefficient index of 0.699. Restriction sites are underlined, start and stop codons are bolded, the Kozak sequence is italicised, the BbvCI and BlnI sites are boxed, and the positions of the two silent mutations are double underlined.

GCTAGCGCCACCATG**TCTAGAACCCCTGGCACCCAGTCCCCCTTCTTTCTCCTG**  
 CTGCTGCTCACCGTGCTGACCGTCGTGACCGGCAGTGGGCATGCGTCCTCGA  
 CGCCCGCGGCGAGAAGGAGACCAAGTGCTACCCAGCGCAGCTCTGTGCCTTC  
 10 CAGCACGGAGAAGAACGCTGTGAGTATGACTTCCTCCGTGCTGTCTCTCCATA  
 GCCCCGGCTCGGGCAGCTCCACCACCCAGGGGCGAGGACGTGACACTGGCTCC  
 CGCAACCGAGCCCCGCCTCTGGCTCTGCCGCCACCTGGGGCCAGGACGTGACA  
 TCCGTGCCCGTGACCCGCCCGGCCCTGGGCAGCACCAACCCCCCTGCTCATG  
 ACGTCA**CCTCAGC**CCCGGACAACAAGCCAGCCCCGGGCTCCACCGCCCCCCC  
 15 AGCCACAGGTGTACCTCGGCCCGGACACCAGGCCGGCCCCGGGCTCCACC  
 GCCCCCCCAGCCACGGTGTACCTCGGCCCGGACACCAGGCCGGCCCCCG  
 GGCTCCACCGCCCCCCCAGCCACGGTGTACCTCGGCCCGGACACCAGGC  
 CGGCCCGGGCTCCACCGCCCCCCCAGCCACGGTGTACCTCGGCCCGGA  
 CACCAGGCCCGCCCCGGGCTCCACCGCCCCCCCAGCCACGGTGTACCTCG  
 20 GCCCGGACACCAGGCCCGCCCCGGGCTCCACCGCGCCCGCAGCCACGGT  
 GTCACCTCGGCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCCCCCAAG  
 CCCACGGTGTACCTCGGCCCGGACACCAGGCCGGCCCCGGGCTCCACCGC  
 CCCCCAGCCCATGGTGTACCTCGGCCCGGACAACAGGCCCGCCTTGGGC  
 TCCACCGCCCCTCCAGTCCACAATGTACCTCGGCCTCAGGCTCTGCATCAG**G**  
 25 **CTCAGC**CTCCACACTGGTGCATAACGGAACCTCCGCGCGCGCCACCACCACC  
 CAGCGAGCAAGAGCACCCCTTCTCTATCCCCTCCCATCATAGCGACACACC  
 ACCACGCTGGCCAGCCATAGCACCAAAACCGACGCCTCTAGCACCCACCACTC  
 CACGGTGCCCCCCTGACCTCCAGCAACCATTCTACCTCCCCCAGCTGTCCA  
 CGGGGGTGAGCTTTTCTTCTCTGTCCTTCCATATCAGCAACCTCCAGTTCAATT  
 30 CCTCTCTGGAGGACCCAGCACCGACTACTACCAAGAGTTGCAGCGGGACATC  
 TCCGAGATGTTCTCTGCAGATCTACAAACAGGGCGGCTTCTGGGATTGAGCAA  
 CATCAAGTTCCGCCCCGGGTCCGTGGTGGTGCAGCTCACCTGGCCTTCAGG  
 GAGGGCACCATCAACGTGCATGACGTGAGACCCAGTTCAATCAGTATAAGAC  
 CGAGGCCGCTCCCGGTACAACCTGACGATCAGCGACGTGTCTGTGTCCGAC  
 35 GTGCCCTTCCCCTTCTCCGCACAGTCCGGCGCCGGCGTGCC**IGGCTGGGGCA**  
 TCGCCCTGCTCGTGTTGGTGTGCGTGCTCGTGGCCCTCGCCATCGTGTACCTG  
 ATCGCCCTGGCCGTCTGTGAGTGCAGGAGAAAGAACTATGGGCAGTTGGATAT  
 CTTCCCCGCCAGGGACACCTACCACCCCATGTCCGAGTACCCACCTACCACA  
 CCCACGGCCGCTATGTCCCTCCCTCCTCGACCGACCGCTCCCCTTACGAGAAG  
 40 GTGAGCGCCGGCAACGGAGGCAGCTCCCTGTCCTACACCAACCCTGCCGTGG  
 CCGCCACAAGCGCCAACCTGTCTAGATGACTCGAG

Figure 6 – Comparison of expression of native MUC1 (JNW656) and codon modified MUC1 (JNW758) following transient transfection into CHO cells.

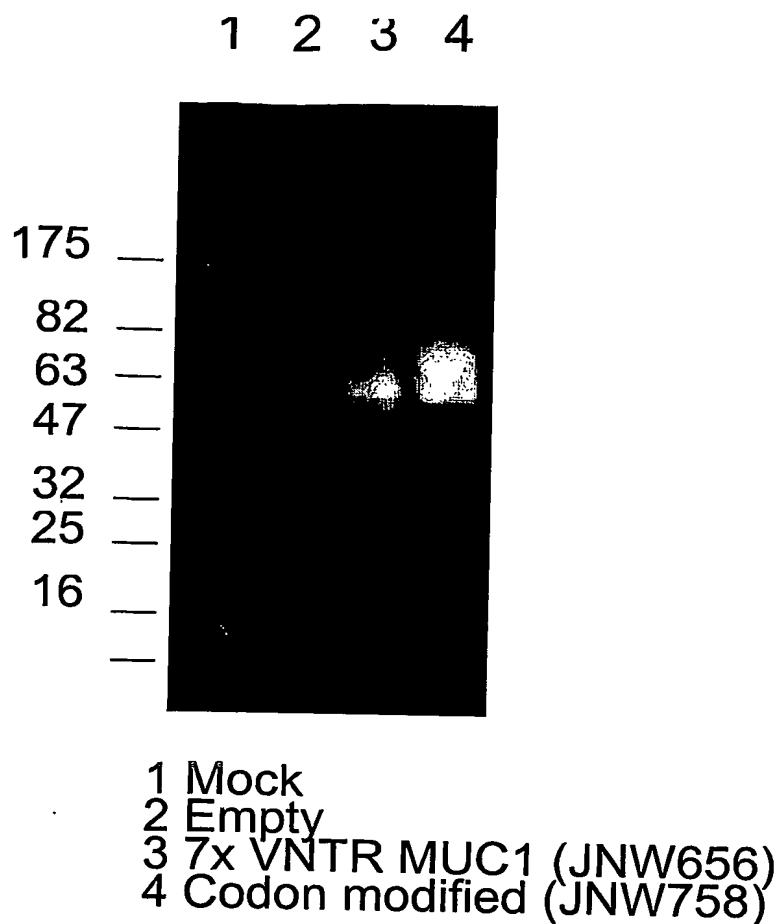


Figure 7 – Comparison of the IFN $\gamma$  ELISPOT cellular responses following PMID immunisation with pVAC empty (control), 7x VNTR MUC1 (JNW656) and codon modified 7x VNTR MUC1 (JNW758). SAP is the CD8 MUC1 epitope SAPDNRPAL.

5 Each bar represents an individual mouse.

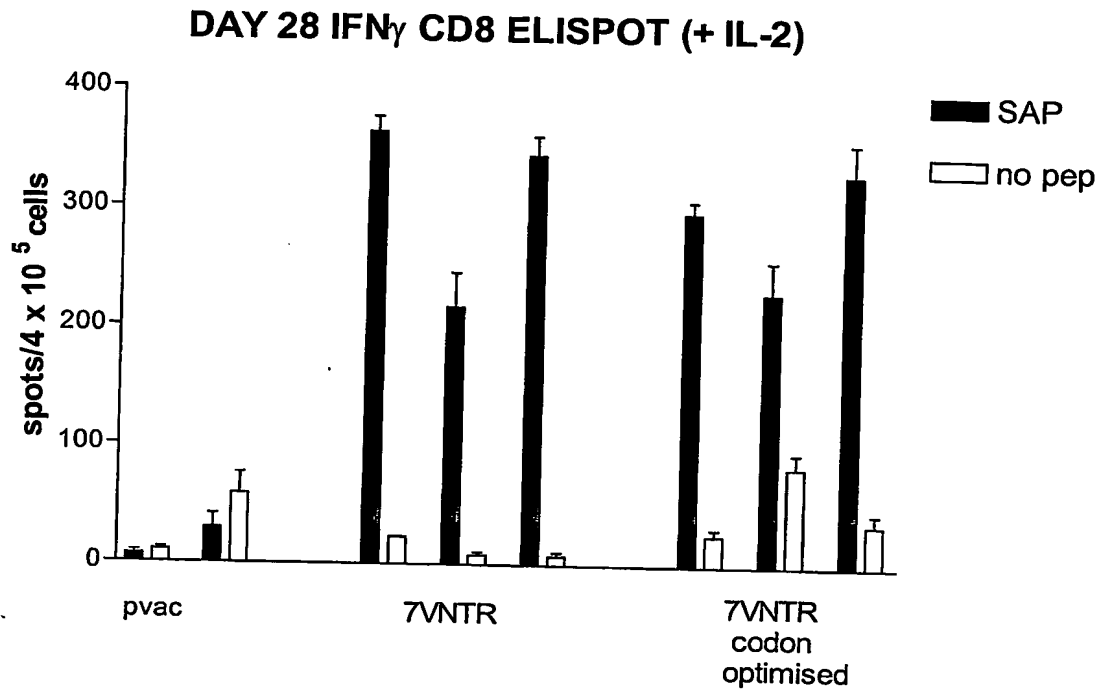
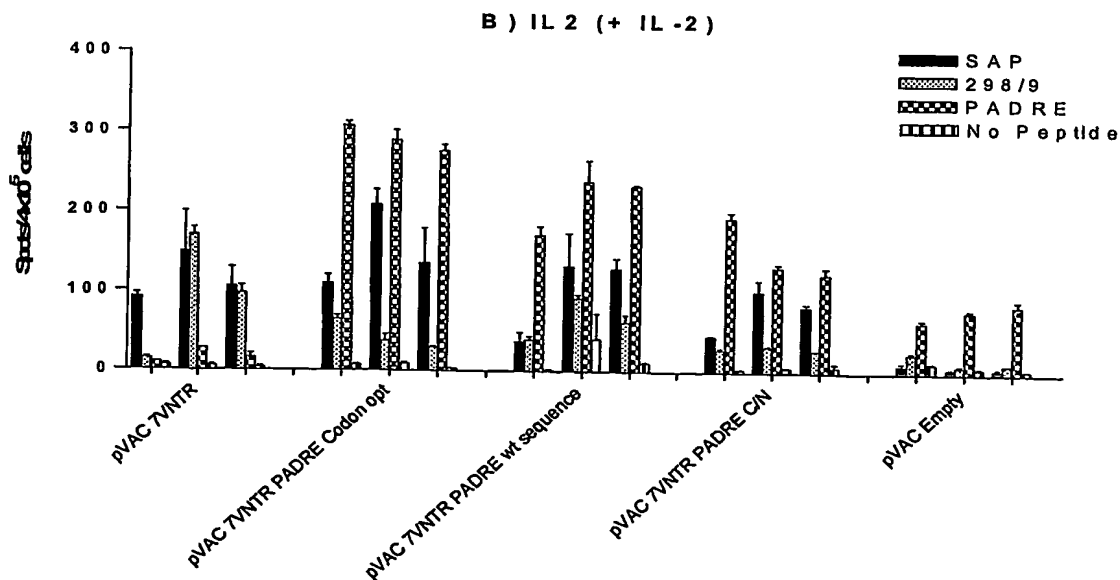
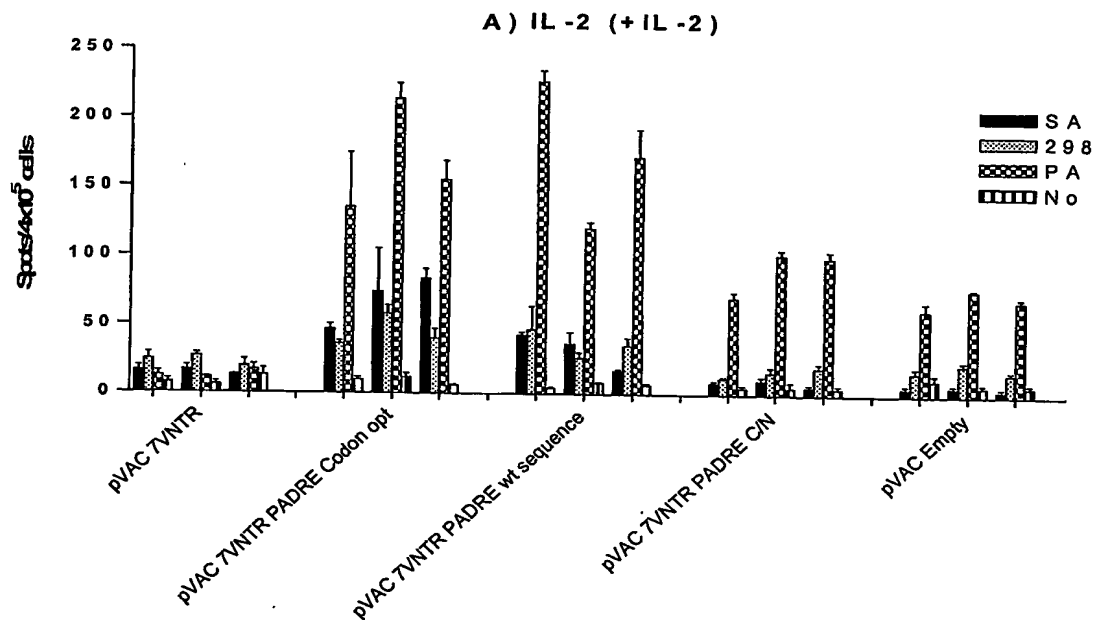


Fig 8. Comparison of the IL-2 ELISPOT cellular responses following PMID immunisation with PVAC 7 VNTR, PVAC 7 VNTR-PADRE-C (codon optimised sequence), PVAC 7 VNTR-PADRE-C (wt sequence), PVAC 7 VNTR-PADRE C/N' (codon optimised sequence) and PVAC empty (control). Responses were read using SAP (CD8 T cell MUC1 peptide), 298/9 (CD4 T cell MUC1 peptide) and PADRE peptide. Analysis was performed at day 28 (A) and 49 (B).



**Figure 9****7x VNTR MUC1 (plasmid JNW656)**

Protein sequence

5 MSRTPGTQSPFFLLLLLTVLTVVTGSGHASSTPGGEKETSATQRSSVPSSTEKN  
 AVSMTSSVLSSHSPGSGSSTTQGQDVT LAPATEPASGSAATWGQDVTSVPVT  
 RPALGSTTPPAHDVTSAPDNKPAPGSTAPPAHGVTSAPDTRPAPGSTAPPAHG  
 VTSAPDTRPAPGSTAPPAHGVTSAPDTRPAPGSTAPPAHGVTSAPDTRPAPGS  
 10 TAPPAHGVTSAPDTRPAPGSTAPAAHGVTSAPDTRPAPGSTAPQAHGVTSAPD  
 TRPAPGSTAPPAHGVTSAPDNRPALGSTAPPVHNVTASGSASGSASTLVHNG  
 TSARATTTASKSTPFSIPSHHSDTPTTLASHSTKTDASSTHHSTVPPLTSSNHS  
 TSPQLSTGVSFFFLSFHISNLQFNSSLEDPSDYYQELQRDISEMFLQIYKQGGF  
 LGLSNIKFRPGSVVVQLTLAFREGTINVHDVETQFNQYKTEAASRYNLTISDVS  
 15 VSDVPFPFSAQSGAGVPGWGIALLVLCVLVALAIVYLIALAVCQCRKKNYG  
 QLDIFPARDTYHPMSEYPTYHTHGRYVPPSSTDRSPYEKVSAGNGGSSLSYTN  
 PAVAATSANLSR.

DNA sequence

20 ATGTCTAGAACACCGGGCACCCAGTCTCCTTTCTTCTGCTGCTGCTCCTCACAGTGCTTACAGTTGTTACAGGTTCTGG  
 TCATGCAAGCTCTACCCAGGTGGAGAAAAGGAGACTTCGGCTACCCAGAGAAGTTCAGTGCCAGCTCTACTGAGAAGA  
 ATGCTGTGAGTATGACCAGCAGCGTACTCTCCAGCCACAGCCCGGTTTCAGGCTCCTCCACCACTCAGGGACAGGATGTC  
 ACTCTGGCCCCCGGCCAGGAACAGCTTCAGGTTTCAGTGCCACCTGGGGACAGGATGTACCTCGGTCCCAGTCAACAG  
 25 GCCAGCCCTGGGCTCCACCACCCCGCCAGCCACGATGTACCTCAGCCCCGGACAACAAGCCAGCCCCGGGCTCCACCG  
 CCCCCCAGCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCCCCCAGCCACGGTGT  
 ACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCCCCCAGCCACGGTGTACCTCGGCCCCGGACACCAG  
 GCCGGCCCCGGGCTCCACCGCCCCCAGCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCG  
 CCCCCCAGCCACGGTGTACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCGCCCGCAGCCACGGTGT  
 30 ACCTCGGCCCCGGACACCAGGCCGGCCCCGGGCTCCACCGCCCCCAAGCCACGGTGTACCTCGGCCCCGGACACCAG  
 GCCGGCCCCGGGCTCCACCGCCCCCAGCCATGGTGTACCTCGGCCCCGGACAACAGGCCCGCTTGGGCTCCACCG  
 CCCCTCCAGTCCACAATGTACCTCGGCCTCAGGCTCTGCATCAGGCTCAGCTTCTACTCTGGTGACAAACGGCACCTCT  
 GCCAGGGCTACCACAACCCAGCCAGCAAGAGCACTCCATTCTCAATTCCAGCCACCACTCTGATACTCTACCACCT  
 TGCCAGCCATAGCACCAAGACTGATGCCAGTAGCACTCACCATAGCACGGTACCTCCTCTCACCTCCTCAATCACAGCA  
 35 CTCTCCCCAGTTGTCTACTGGGTCTCTTTCTTTTCTGTCTTTTCACATTTCAAACCTCCAGTTTAATTCTCTCTG  
 GAAGATCCAGCACCGACTACTACCAAGAGCTGCAGAGAGACATTTCTGAAATGTTTTGAGATTATAAACAAGGGGG  
 TTTTCTGGGCTCTCCAATATTAAGTTCAGGCCAGGATCTGTGGTGGTACAATTGACTCTGGCCTTCCGAGAAGGTACCA  
 TCAATGTCCACGACGTGGAGACACAGTTCAATCAGTATAAAACGAAGCAGCCTCTCGATATAACCTGACGATCTCAGAC  
 GTCAGCGTAGTGATGTGCCATTTCCTTTCTCTGCCCCAGTCTGGGGCTGGGGTGCCAGGCTGGGGCATCGCGTGTGGT  
 40 GCTGGTCTGTGTTCTGGTTGCGCTGGCCATTGTCTATCTCATTCGCTTGGCTGTCTGTCTGTGAGTCCGCCGAAAGAACTACG  
 GGCAGCTGGACATCTTTCAGCCCCGGGATACCTACCATCCTATGAGCGAGTACCCACCTACCACCCATGGGCGCTAT

GTGCCCCCTAGCAGTACCGATCGTAGCCCCCTATGAGAAGGTTTCTGCAGGTAATGGTGGCAGCAGCCTCTCTTACACAAA  
CCCAGCAGTGGCAGCCACTTCTGCCAACTTGTCTAGATAG